No. 21, 1916.

UNION OF SOUTH AFRICA.

T OF AGRICULTURE

Some Viticultural and Oenological Experiments conducted at the Paarl Viticultural Experiment Station during 1915-1916

By Dr. A. I. PEROLD
Government Viticulturist for the Union of South Africa

PRETORIA
THE GOVERNMENT PRINTING AND STATIONERY OFFICE
1916

Printed by the Government Printer, Pretoria

7168—11.11.16—3000

Some Viticultural and Oenological Experiments conducted at the Paarl Viticultural Experiment Station during 1915-1916.

By Dr. A. I. Perold, Government Viticulturist for the Union of South Africa.

Introductory.

As an annual report has to be very brief, any details about experimental work have to be omitted, but these are of the greatest importance to viticulturists, and should, therefore, be brought to their notice. It is with this object in view that the present bulletin has been written.

The experiments are here grouped as follows:—

A. Viticultural: (*a*) Pruning and Trellising.
(*b*) Sunburning of Grapes.
(*c*) Thinning of Table Grapes.
(*d*) Almeria Grapes.
(*e*) Local Sales of Table Grapes.
(*f*) Experimental Shipments of Export Grapes.

B. Oenological: (*a*) Hock Type.
(*b*) Claret Type.
(*c*) Sherry Type.
(*d*) Port Type.
(*e*) Wine Brandy (Cognac Type).

A. Viticultural Experiments.

(*a*) *Pruning and Trellising.*—After trying different systems with over 100 different varieties of grapes for several years, it can now be stated that only such vigorous varieties as Molinera Gorda (or Meraviglia de Malaga and Castiza, with which it is practically identical), Black Manukka, White Crystal, and a few others, together with such varieties as need long pruning to give good crops, e.g. Sultana, Ohanez (Almeria), Black Currant (Cape), Karroo Belle, Cabernet Sauvignon, and a few others, answer well when trellised and pruned according to the Cazenave system. Here we have a permanent trunk on the bottom wire with 4–6 short and long (about 8–10 eyes) bearers to each vine, the long bearers being tied to the middle wire. Varieties bearing well with short pruning will give too heavy crops with long pruning, with the result that the grapes ripen badly and are of poor quality, whilst the vines at the same time suffer visibly. Most varieties of table grapes give the best results when only short bearers of 2–3 eyes are given about 9 in. apart on a permanent trunk resting on a strong (No. 8 or 10) wire with a second wire (say No. 12) about 12 in. above it. Quite sufficient quantity and very satisfactory quality are thus obtained.

The modification of the Cazenave system known as the "fish-spine method," where the long bearers are tied to outside wires, 15–18 in. away

from the trunk and on both sides of it, alternately to the one and then to the other wire, gave better results than the Cazenave system in the case of Flame-Coloured Tokai, as sun-burning was thereby very much reduced. This "fish-spine method" also seems very useful for the Almeria grape (Ohanez) as well as for Sultana.

The overhead trellising (Pergola and the Almeria system) has thus far given good results in the case of table grapes. For the Almeria grape the overhead trellis gave twice as big a crop as the low trellis, even with long pruning. This trellising has thus far not given any special results in the case of wine grapes. The sugar content of these grapes when ripe was a little lower than in the case of vines not trellised, but the difference was not great. Sunburning practically never occurs on an overhead trellis.

(*b*) *Sunburning of Grapes.*—This a serious matter in hot places like Paarl. Whilst it is certain that deep, cool soils with a loose soil mulch on the surface will cause much less sunburning than dry soils, it still sometimes happens that the air gets so hot (102°–104° F. in the shade), that the grapes burn badly. This is usually worst between the 30th December and 4th January. Later on, as the grapes get sweeter and the acidity decreases, sunburning is less to be feared. Experiments made with hessian to provide artificial shade between 12 noon and 4 p.m., have given some useful results, but it is felt that this is not the real solution of the problem. *Trellising has done more than anything else.* The "fish-spine" method of trellising gave rise to much less sunburning in the case of Flame-Coloured Tokai, which is a very susceptible variety, than the Cazenave system. The experiment will now be extended to Gros Maroc, which is another variety extremely susceptible to sunburning. High and overhead trellising so far proved to be the most effective means of preventing sunburning. It will, therefore, pay well in the case of Hanepoot, Flame-Coloured Tokai, and Gros Maroc.

(*c*) *Thinning of Table Grapes.*—As is well known, this is an essential factor in the production of the best table grapes. In order to determine approximately the percentage of berries that should be removed in case of the different varieties of grapes, four to thirteen bunches of grapes of a number of varieties were carefully thinned on the 30th November, 1st, 8th, and 9th December, and the number of berries removed, as well as those remaining after thinning, were counted, whence the percentage removed in each case was calculated. The results were as follows:—

Variety.	Number of Bunches Thinned.	Percentage Berries Removed.
Laubscher's Gem	5	36–61, average 49
Prune de Cazouls	13	23–57, ,, 43
Henab Turki	7	40–46, ,, 48
Trifere du Japon	4	41–53, ,, 44
Gros Colman	6	28–52, ,, 43
Bailey	4	48–54, ,, 51
*Kirsten	5	64–73, ,, 67
Barlinka	5	38–47, ,, 42
Gros Maroc	5	40–56, ,, 48
Bonnet de Retord	5	50–58, ,, 53
Tribodo Nero	5	39–50, ,, 46
Formosa	5	50–60, ,, 53
Cinsaut (same as Hermitage)	5	42–53, ,, 48
Schiradzouli Blanc	5	37–53, ,, 44

Subsequent results have shown that the bunches in question were properly thinned. The above table shows that in the same variety there are considerable differences between the percentages of berries to be removed from different bunches. It is, therefore, not possible to say precisely what percentage of berries should be removed in thinning each variety of grape. Still, it will be noticed that there are on the whole considerable differences between the different varieties. Thus the variety called "Kirsten," which is marked with an asterisk in the above list, needed very heavy thinning indeed as compared with the other varieties. When table grapes for export are to be produced upon a large scale, we should try to grow such varieties as do not require to have more than about 45 per cent. of their berries removed when thinning, unless they are of such great excellence as to pay well for this extra amount of work. In the above list Gros Colman, Barlinka, and Prune de Cazouls required least thinning (42–43 per cent.), and they are three excellent export varieties.

In the case of Rosaki di Smyrna and Dattier de Beyrouth, all the thinning required consisted in removing the few small berries. They, indeed, require less thinning than any other varieties known to the writer. They are excellent for export. Hanepoot requires a very variable amount of thinning. In years when the berries have set well, it will require up to 50 per cent. thinning, whereas in years when the berries have set badly, the thinning will be almost nil, and will be limited to the removal of a few small berries.

(*d*) *Almeria Grapes.*—As it was felt that the Almeria grape should have a great future in South Africa, cuttings of this variety, known as Ohanez, were imported into the Cape early in 1910, through the good offices of the British Consul in Almeria. It was in due course propagated at the Paarl Viticultural Station, where it is grown on different systems of trellising, including the Almeria overhead trellis. It was grafted on Jacquez and on Aramon, both thus far doing well. The 1915 crop, which was fairly heavy, was almost completely destroyed by the ordinary Fruit Fly.

The 1916 crop was a good one. By applying two sprays with poisoned bait against Fruit Fly on the 22nd February and 3rd March, the whole crop was saved. It would, therefore, appear that the Fruit Fly is not any serious difficulty in the production of Almeria grapes. Owing to a more favourable season, the grapes were picked on the 14th March, which was about six weeks earlier than the year before. The best results were obtained from the overhead trellis (Almeria system), where the ninety-six vines, planted 6 ft. × 6 ft., gave an average of one 10-lb. box of grapes per vine, which is very satisfactory. Half of these grapes was exported to London and fetched from 6s. to 8s. per box. The remainder was sold on the Johannesburg market as follows:—On 20th June, 12 boxes at 5s. to 6s. per box; on 4th July, 15 boxes at 5s. per box; on 9th August, 9 boxes at 7s. to 8s. per box. The average price realized was 5s. 8d. per box. It must, however, be pointed out that just a little more than half of the grapes harvested for local sale could thus be sold, as there was a fair loss in keeping them so late. This would still work out at an average price of about 3s. per 10-lb. box harvested, which is very profitable indeed. These grapes were stored in the wine cellar, some being packed in corkdust and others wrapped in paper, each bunch by itself. Neither of these methods seem to be very satisfactory. In future the Almeria grapes will be stored by packing them in single layers on fruit trays, which will be kept in a fairly cool and dry place, stacked one on top of the other. This has already been done last season by a private farmer on my advice, and was attended with very good results. I prefer this method to keeping in cold store. Future experiments will, no doubt, prove the accuracy of my contention.

Those Almeria grapes shipped to England were packed in the usual 10-lb. box (each bunch being wrapped in tissue paper by itself), and were sent over in ventilated hold, arriving in good condition. The prices realized were quite satisfactory, as was shown above. Next season some boxes will be exported with the grapes packed in corkdust, to determine which manner of packing pays best. The grapes were sold on the Covent Garden Market, London, on the 10th May. Those picked in the ampelographic collection were specially marked "A.C.," and they were on the whole riper than those picked from the overhead trellis. In his report on this consignment (40 boxes), the Trades Commissioner, Mr. Chiappini, writes as follows:—

> "The portion of the shipment marked 'A.C.' had a fair percentage of wasty berries. The portion which had no distinguishing mark were in quite good condition, hardly a bad berry to be found."

This simply corroborates the experience in Almeria, where the grapes are picked a bit on the green side, to make them keep longer and better. It is, therefore, advisable to pick the Almeria grape when it is just ripe, but before it is dead ripe.

(*e*) *Local Sales of Table Grapes.*—In all 155 10-lb. boxes of a large number of different varieties of table grapes from the Paarl Experimental Station were sold on the Johannesburg market between 1st February and 25th March, 1916. The prices were uniformly satisfactory, the average price being 3s. 4d. per box. The grapes were quite ripe and of good quality, although not "extra selected." This shows that in the case of local sales it pays to put up the grapes in small parcels and to send good, ripe stuff to the markets. Growers should note this fact, and develop this line of trade, in preference to selling their whole crops of good Hanepoot and other grapes at 3s. to 4s. per basket of at least 50 lb. grapes.

(*f*) *Experimental Shipments of Export Grapes.*—During the last export season 185 standard 10-lb. boxes of table grapes were exported from the Paarl Experimental Station to London and consigned to the Trades Commissioner, who carefully inspected each consignment, had them sold at Covent Garden, and fully reported upon the results. The following are the opening remarks in his report on these experimental shipments:—

> "What I consider to be the most important experiments ever made in regard to the fruit trade were those made by Dr. Perold (the Chief Viticulturist of the Government), who made several shipments including many varieties of new types of table grapes grown at the Government experimental plot at the Paarl. Great care was taken in the details of the shipments, and the results were most satisfactory. . . . I personally inspected every consignment very carefully, always in company with Covent Garden dealers, and I hope the experiments will be continued next year."

These shipments comprised thirty different varieties of table grapes. On account of the small number of boxes sent of each variety (in some cases one or two only), the prices realized do not reflect the correct value of the different grapes for export purposes. The greatest value of these experimental shipments consists in the careful reports made about their travelling qualities, and the public favour that the different varieties are likely to find at Covent Garden. The following are some of the best varieties for export:—

(*a*) *Varieties already largely exported.*—Gros Colman, Red and White Hanepoot, Barbarossa, Hermitage, and Raisin Blanc.

(*b*) *New Varieties, now recommended*:—Gros Maroc, Black Spanish, Muscat Madresfield Court, Molinera Gorda, Olivette Barthelet, Servan Blanc, Dattier de Beyrouth, Rosaki di Smyrna, Barlinka, Prune de Cazouls, Henab Turki, Rosada, and Bonnet de Retord.

The following list gives the prices realized by these varieties this year at Covent Garden Market. It may beforehand be pointed out that these must not be regarded as maximum prices, as they are unduly low on account of the small number of boxes, usually only two to six or even one, that could be offered for sale.

Gros Colman			15s.,	average	15s.
Dattier de Beyrouth			14s.,	,,	14s.
Henab Turki	10s.	to	14s.	,,	12s.
Black Spanish			12s.	,,	12s.
Olivette Barthelet			12s.	,,	12s.
Gros Maroc	10s.	to	12s.	,,	11s. 6d.
Molinera Gorda	9s.	,,	13s.,	,,	11s. 5d.
Barbarossa	10s.	,,	12s.,	,,	11s. 4d.
Rosaki di Smyrna			11s.,	,,	11s.
Servan Blanc	10s.	to	12s.	,,	11s.
Red Hanepoot	10s.	,,	12s.,	,,	10s. 8d.
Muscat Madresfield Court	9s.	,,	12s.,	,,	10s. 6d.
Raisin Blanc	9s.	,,	12s.,	,,	10s. 6d.
Barlinka	10s.	,,	12s.,	,,	10s. 4d.
Prune de Cazouls	10s.	,,	12s.,	,,	10s. 4d.
Rosada			10s.,	,,	10s.
Hermitage	9s.	to	10s.	,,	9s. 3d.
Formosa	7s. 6d.	,,	10s.,	,,	8s. 9d.
Bonnet de Retord	8s.	,,	9s.,	,,	8s. 4d.

Notes on the above Varieties.

About the old standard varieties it need simply be said that Gros Colman is the best of all, and is closely followed by Red and White Hanepoot and Barbarossa. Hermitage is quite a paying variety where it is early, hardy and gives big berries. It will probably always be shipped on account of being early. Raisin Blanc, however, should steadily be replaced by Servan Blanc.

Of the new varieties *Dattier de Beyrouth* and *Rosaki di Smyrna* are two large oval-berried white varieties, that carry very well and fetch very good prices. They are mid-season varieties. This year a lot of the berries of Rosaki showed a tendency to drop off when arriving on the market, on account of the long voyage and the thin stalks of this grape. They deserve to be grown to a very considerable extent.

Henab Turki is a late grape that carries very well indeed, and forms big, nearly round berries with a pitch black colour when properly ripe. It is late but bears well, and is one of the coming varieties if grown on early sites. Mr. Chiappini writes about this variety that "dealers thought very well of this variety, and along with 'Molinera Gorda' is one of the best out of the whole experiments. It should prove a very fine export grape, but further experiments should be made."

Black Spanish.—This is a variety of considerable merit. Its berries are large, black, and of fairly good flavour. It is a very good cropper and most of the bunches are fit for export. Its cultivation can safely be encouraged.

Olivette Barthelet is a very promising new white variety. It forms fairly big bunches with good-sized berries. It travels better than Raisin Blanc,

and has a firm flesh, while the berries cling to the stalks well. This grape made a good impression on the Covent Garden trade. One box was kept in the show window of the Trades Commissioner for thirteen days, when the grapes were still in good condition.

Servan Blanc is a very late white grape that gives beautiful bunches with fair-sized berries, and will probably altogether take the place of Raisin Blanc, to which it is decidedly superior. The average price realized was 11s. per box, notwithstanding the fact that this variety had not been thinned out previous to shipping. It is largely grown in the south-east of France as a late-keeping white grape. Its cultivation can be strongly recommended.

Gros Maroc is an excellent large-berried black grape that will in course of time very closely come up to Gros Colman both in quality and price. Its great drawback, however, is that it burns very easily. It should, therefore, be grown on high trellises or possibly on the fish-spine trellis, or in districts where sunburning is not to be feared. It travels really well, and is a most excellent grape for export.

Molinera Gorda.—This is a red grape with round berries and large bunches; it is a vigorous grower and good cropper. It never suffers from sunburning, ripens as early as Hermitage, and will last throughout the export season. It possesses excellent keeping qualities, as is shown by the report of the Trades Commissioner in London, where he states the following:—

> "It arrived in excellent condition, and apparently is a marvellous keeping grape. The berries cling on exceptionally well, and I might almost say that not more than one berry in five bunches dropped during the inspection. One box was placed in my office show window for thirteen days, after taking seven days in coming from the ship, making a total of twenty days in all. I carefully examined the grapes afterwards, and there was hardly a berry affected in the whole box."

The grapes had thus been cut from the vines about seven weeks ago. Mr. Chiappini further adds: "I think this variety will prove an excellent one for export, and dealers here are much impressed with it." As it is further a variety that will give fairly big berries with a little thinning, it could be grown on a fairly large scale, to be shipped as "selected," and will still make good prices. This season the average price was 11s. 5d. per box. It can be strongly recommended to all growers, as it is easy to please and will succeed in early as well as late districts. This grape is exported from Almeria in Spain during the four weeks preceding the exportation of the Almeria (Ohanez) grape from this district.

Muscat Madresfield Court.—This is a very good cropper, suffers little from sunburning, ripens mid-season, has a nice muscat flavour (which is much liked at Covent Garden, where it is well known), and Mr. Chiappini thinks that shipments of this grape should be encouraged.

Barlinka.—This is a beautiful black grape, with strong bloom. It is at present little known, and was specially imported by myself from a small village in Algeria. Mr. Chiappini writes about this grape as follows:—

> "This is an extremely nice black grape, and arrived in very good condition. The berries clung on well, whilst the flavour was quite good. This will probably prove to be a very saleable variety. It made from 10s. to 12s. per box."

Its cultivation is strongly recommended.

Prune de Cazouls is a very large-berried black Sicilian grape, which bears well and forms about the largest berries amongst the black varieties. It is very easy to thin, and is a vigorous grower. This variety will probably always command a good price, and should, therefore, be tried by growers of export grapes.

Rosada is a red variety that is exported from Almeria together with the Molinera Gorda. As the name shows, it has a rose or pink colour. The berries are very firm, and it is a peculiar, pretty grape. It travels well, and Covent Garden dealers think that it will possibly take on there when it becomes better known.

Bonnet de Retord is a peculiar striped black grape, very firm flesh and tough skin, the berries sticking very well to the pedicels. It is an excellent traveller and beautiful keeper. Where the soil is good and not too dry, the berries will reach a good size for export. The flavour is quite good. It is a deserving variety that might be tried by exporters.

B. Oenological Experiments.

(*a*) *Hock Type.*—In these experiments two different methods were tested. First the method whereby the grapes are crushed, immediately pressed in the freshly crushed state, and the combined must is pumped into a stukvat, where it is allowed to ferment by an addition of about 1 per cent. pure yeast. The temperature during fermentation is controlled by cooling the must when necessary. As far as possible the temperature is kept below 90° F. or 32·2° C.

The other method consists in adding about ½ lb. potassium meta-bisulphite to the must got from 1 ton of grapes by crushing and pressing immediately afterwards. The must is pumped into a cement tank, where it is left for 36 to 48 hours when the clear supernatant liquid is siphoned or pumped out, immediately pumped into a stukvat, and about 1 per cent. pure yeast is added. This second process was only tried in the case of White French grapes.

No difficulty was experienced in either case with the fermentation. Sometimes, particularly during hot weather, the must had to be cooled by pumping through a cooler. In four to six days the young wine was usually dry.

The acidity of the must was corrected by adding sufficient tartaric acid to raise the total acidity of the must to about 7 per mille. Latterly the acidity has not been raised beyond 6 per mille, as 7 per mille was found to be rather too high. The wine was racked for the first time about eight days after pressing, then again about one month later, and again towards the end of winter, some time in August. The wines were matured in two-leaguer stukvats, which were closed by means of big perforated rubber bungs, into which fitted special glass vessels, which again were closed by a perforated cork with a bent glass tube containing a little dilute sulphuric acid to act as an airseal. This is an excellent arrangement. The cask is filled completely, until the wine nearly fills the glass vessel on top of the cask. In this way one can see, when walking through the cellar, whether the casks have been properly filled up. If an unexpected fermentation should suddenly set in, the cask will not burst, as the gas can escape through the airseal. In this way very excellent wines were made from Greengrape and White French. When 2½ years old, these wines were perfectly bright without having been either fined or filtered. They had a nice bouquet and were much appreciated by wine merchants.

The second method gave a wine much resembling the Witzenberg wine, with a distinct Moselle character about it. On the whole, both methods are equally good in normal years. Only when the grapes reach the cellar in a

somewhat decomposed state owing to rainy weather, the second method will be the better of the two. The great secret is to get the wines dry soon, and subsequently to fill the casks once or twice a week so as always to keep them quite full. In order to do this, pure yeast, a good cooler, and the glass vessels for keeping the vats full, are strongly recommended.

6 (*b*) *Claret Type.*—Past experience has shown that a good, dry, red wine for table use cannot be made from Hermitage in the Paarl district. Therefore Cabernet Sauvignon (about 550) and Malbec (about 450) vines were planted in 1914. They gave their first crop during the 1916 vintage, when in their third leaf, and thus 2½ years old. The crop was 113 baskets grapes or about 2⅓ leaguers wine from the 1000 vines. This was a good yield from such young vines. The Malbec yielded about 40 per cent. more heavily than the Cabernet. The musts had the following composition :—

	Sugar in degrees Balling.	Total Acidity as Tartaric Acid.
Cabernet Sauvignon...	24·0°	6·8 per mille.
Malbec.....	22·2°	6·8 per mille.

7 The grapes were crushed in a foulior-égrappoir, which removed the stalks. The husks and the must were inoculated with pure yeast when the grapes had been crushed. The floating cake of husks was pressed under the must by means of a pole with two cross-sticks. This was done every couple of hours for about 10 minutes. After 3½ days or about 84 hours, the wine was drawn off and the husks were immediately pressed, and the press wine added to the rest. The wine was then almost dry. It was stored in a stukvat and further treated in the usual way. It soon got bright and developed a pleasant bouquet with something of a Claret character. It has a splendid dark red colour. On the 9th June, 1916, it was analysed, and gave the following results :—

Alcohol.	Total Acid (as Tartaric Acid.	Volatile Acid (as Acetic Acid).
12·40 vol. %	5·3 per mille.	0·52 per mille.

8 The vines are planted 3 ft. × 8 ft., are trellised low (two wires), and pruned with long and short bearers (Guyot system), as is practised in the Medoc (Bordeaux district), where they form the basis of the Clarets. The results, both as regards quantity and quality, are thus far very encouraging. Further experiments will be continued in this direction. So much is now already certain, that these two varieties can produce quite a good, dry, red table wine in the Paarl district.

9 (*c*) *Sherry Type.*—Experiments have in the past been made with Stein, Greengrape, and Pedro Jiménez (the false Pedro). The Sherry varieties have only come into bearing last season, so that nothing can thus far be said about them. Of the varieties first mentioned, Stein is not to be recommended for making of Sherry. Its peculiar flavour is a drawback to the matured Sherry. Greengrape and Pedro Jiménez have given good results thus far, but the Sherry made from Greengrape seems to reach a stage of maturation after about four years, beyond which it makes no marked progress, and it even seems to fall off somewhat on being further kept.

10 As I noticed in the ampelographic collection that the Spanish Palomino, which is the basis of Sherry in Spain, is practically identical with our White French, experiments will be made with this variety next vintage in the production of Sherry. I have recently tasted a Sherry made from White French, which was about seven years old, and had a beautiful amontillado nose and character. It is, therefore, quite likely that White French may become our main variety of grape for making a Sherry.

11 All my attempts to grow the flowers of wine on the young Sherries have thus far failed. I think they will succeed with White French, as it gives a wine low in both alcohol and total acid. Meanwhile, pure cultures of *Mycoderma vini* (or Flowers of Wine) are being prepared from different young wines, that naturally tend to become good Sherries. The question as to whether plastering is necessary in the making of Sherry has not yet been decided. Experiments are still being conducted. Meanwhile it must be pointed out that about 1½ lb. plaster of paris per ton of grapes is the most that can be used, without exceeding the total sulphate limit of 2 grs. potassium sulphate per litre in the wine when ready to be sold.

12 My four and five years' old Sherries have developed a strong Sherry character, which is very encouraging. Most white Cape wines tend to develop into Sherries if sufficiently matured in wood, but the production of a very high-class Sherry, approximating closely to the Spanish article, will probably require a number of years and many more experiments in this direction.

13 (*d*) *Port Type.*—Whereas Pontac and Muscadel in the past constituted the basis of Cape Ports, we now have over a dozen varieties of the many varieties grown in the Douro Valley in Portugal for making Port wine. One can distinguish between early and mid-season varieties. The early varieties are: Red Muscadel, Frontignac, Codega (white), Bastardo do Menudo, and Bastardo do Castello. They give very sweet must and good quality. The others come one to two weeks later, and include Tinto Cão, Mourisco de Semente, Mourisco tinto, Malvasia Rey, Malvasia preta, Grenache noir, Touriga, Tinta Francisca, and Tinta Roriz. At the Experimental Station in Paarl it has been found necessary to press the early varieties first, and then the others. The young wines are subsequently blended. The grapes are allowed to get dead ripe before they are harvested. The early varieties gave a must with 26·5° Balling, whilst the later group showed only 22° Balling in the must.

14 The grapes are crushed in a fouloir-égrappoir, which crushes the grapes and removes the stalks at the same time. The husks and must are immediately inoculated with pure yeast and allowed to ferment in a cement tank. The cake of husks is pressed under repeatedly, as described under the "Claret type" above. When the Balling saccharometer shows about 8–10 degrees, the must is drawn off and the husks are pressed out. The united musts are then pumped into a stukvat containing the requisite amount of brandy, which is so calculated that there will be left about 12 in. free below the bunghole, when the necessary amount of must will have been pumped into the cask. By pumping the must on top of the brandy, the two mix well. In one to two days' time the fermentation will usually stop. After about eight days the wine is racked over into another cask, which can then be filled.

15 The amount of brandy required is calculated according to the following formula:—

$$X = \frac{127\ (17 \times 17 + 10b - 10a)}{17\ (s - 17) - 10b}.$$

Where X = number of gallons brandy necessary for every leaguer must.
a = number of degrees Balling of the must.
b = the percentage sugar that the finished wine should have.
s = the strength of brandy in vol. per cent. alcohol.

16 This formula works very well in practice, but has been deduced by myself from theoretical considerations. It is based on the assumption that the finished wine will have 17 vol. per cent. alcohol. This is sufficient to stop the fermentation, and keep the wine whilst maturing in the cellar. The

alcoholic strength is usually raised 1 or 2 vol. per cent. higher in the trade. The brandy used in my experiments is made from ordinary sound wine which is distilled twice, the first and the last runnings being separated from the brandy, to be used in making the Port. The brandy is so distilled, to have a strength of about 74 vol. per cent., or about 30° O.P. The lowest strength allowed by law is 22° O.P., or 69·6 vol. per cent. Great care should be taken in distilling, as a bad brandy will always harm the wine fortified with it. The following example will illustrate the formula given above.

17 The fresh must showed 25° Balling, the brandy was 74 vol. per cent., the Port should have 5 per cent. sugar when finished and have a strength of 17 vol. per cent. alcohol. Here $a = 25$, $b = 5$, $s = 74$.

$$\text{Therefore } X = \frac{127(17 \times 17 + 10 \times 5 - 10 \times 25)}{17\ (74 - 17) - 10 \times 5} = 12 \cdot 3.$$

Thus every leaguer of must will require 12·3 gallons of the above brandy to give the wine wanted.

18 In 1915 about 2½ leaguers Port type wine were made at the Paarl Experimental Station, and in 1916 about 4½ leaguers of the same wine. Both these wines have a pronounced Port character and are most promising at present. From these experiments one can already now predict that we shall in future be able to produce very good wines of the Port type, which may possibly be exported with success in the near future. I am glad to say, that a number of farmers in the various wine districts have already acted upon my advice, and started planting the above Port varieties for making wine of the Port type.

19 (*e*) *Wine Brandy* (*Cognac type*).—In order to make a first class brandy of this type, it is essential that we should start with a good, sound wine. In France Cognac is distilled mainly from the Folle Blanche grape, which has a very high total acidity and fairly low percentage of sugar when ripe. The result is a light wine with a high total acidity. The wine is distilled from one to three months after the vintage, i.e. in cold weather, before it has had any chance of getting sour. No particular care is exercised in making this wine, but the greatest care is taken in distilling it and in maturing the Cognac.

20 I consider that the best brandy will be made from light wine, as we have thus a greater concentration of the vinous characteristics in the brandy than when distilling strong wine.

21 In 1914 the White French grapes at the Paarl Experminental Station were pressed when just ripe, and then showed 17·2° Balling and 4 per mille total acidity. The grapes were crushed and pressed immediately afterwards; the must was pumped into a stukvat, sufficient tartaric acid added to raise its total acidity to about 8 per mille, and the fermentation was started with pure yeast. The maximum temperature of the must during fermentation never exceeded 28° C. or 82·4° F., as it was cooled when necessary. The wine soon got dry and was racked from the first lees. During the latter half of April it was distilled according to the system of Cognac. The wine then had the following composition:—

Alcohol.	Volatile Acidity (as Acetic Acid).	Total Acidity (as Tartaric Acid).
9·6 vol. % or 16·7 % Proof Spirit.	0·54 per mille.	8·47 per mille.

22 It was distilled in a small three halfaums still. First everything was distilled over until the alcoholometer showed 0 degrees. This constitutes the "brouillis" or crude brandy. This was then carefully redistilled. The

first half gallon during the second distillation was kept separate and added to the second still. The good brandy was then collected until the strength of the brandy distilling over went just below 19° Cartier, when the remainder was treated as "naloop" and added to the second still. This "naloop" was collected until the alcoholometer showed 0°, which means 10° Cartier, since pure distilled water shows 10° on the Cartier alcoholometer. In this way everything was carefully distilled, with the result that the 270 gallons wine gave 33¾ gallons good brandy of "Cognac type" with a strength of 67 vol. per cent. alcohol or 17·4° O.P.; this means that eight leaguers of this wine would thus give one leaguer of brandy.

This brandy was put into a new quarter cask of Limousin oak, which had previously been well steamed. The brandy was very clean and matured fast. It was kept on the cellar loft under a thatched roof. Now it is a fine, soft brandy that can well be consumed, after having matured in French oak for about 2½ years. This brandy, which I can guarantee as absolutely pure and natural, now has a fine golden colour and a strong Cognac character. It very closely resembles the genuine French Cognac, and certainly approximates more closely to it than any other South African brandy that I have seen thus far.

After this experience I feel confident that we can produce a very fine wine brandy of Cognac type, if we only care to do so. For this purpose I most strongly recommend the White French grape, together with the grapes grown in the Cognac district, namely Folle Blanche (best), Colombard, and Saint Emilion. This class of brandy could well be exported, and give a good profit to the growers. Cuttings of the varieties of grapes just mentioned can be obtained from the Government Viticulturist, Elsenburg, Muldersvlei, C.P.

Experiments similar to the above are still being continued, and will be reported upon at a later stage.